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CIVIL ENGINEERS

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Vol. IV JUNE, 1917 No. 6

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PROCEEDINGS

NOTICE OF REGULAR MEETING.

A REGULAR meeting of the Boston Society of Civil Engineers will be held on

WEDNESDAY, JUNE 13, 1917,

at Norumbega Park, Newton, in connection with the joint Field Day of the New England Water Works Association and this Society. This meeting will consist of a brief business meeting, which will be held at the conclusion of the dinner.

Business of the meeting: Announcement of the result of the letter ballot on the adoption of the Resolution on the Formation of a Regiment of Engineers.

Action on the following vote, which was passed at the last meeting of the Society: *Voted,* that a sum not exceeding five hundred dollars be appropriated from the income of the Permanent Fund for the improvement and furnishing of the Society rooms.

Under the By-Laws, it requires an affirmative vote of two thirds at two successive regular meetings, to make an appropriation from the Permanent Fund.

S. E. TINKHAM, *Secretary.*

PAPERS IN THIS NUMBER.

"The Engineering Society in War Time." George C. Whipple.

"Military Sanitation." W. P. Chamberlin.

"Organization and Duties of Engineer Troops." Frederick B. Downing.

"Engineering Instruction Now being Given by the First Corps Cadets and the Formation of a New Engineer Regiment." John F. Osborn.

CURRENT DISCUSSIONS.

Paper.	Author.	Published.	Discussion Closes.
"History and Present Status of the Concrete Pile Industry."	C. R. Gow.	April.	Aug. 10.
"China Mills Dam and Sluiceway of Suncook Mills."	A. T. Safford.	May.	Aug. 10.
"When to Dimension in Feet and Inches and When in Inches Alone."	S. H. Thorndike.	May.	Aug. 10.

MINUTES OF MEETING.

BOSTON, May 16, 1917. — A regular meeting of the Society was held this evening in Chipman Hall, Tremont Temple, and was called to order at 7.50 o'clock by the President, George C. Whipple. There were 92 members and visitors present.

The reading of the record of the regular meeting of April 18, and that of the special meeting of April 11, was, by vote, dispensed with and they were approved as printed in the May JOURNAL.

The President reported for the Board of Government that it had elected to membership in the grade of member, Messrs. Arthur C. Eaton and Joseph Leon O'Neil. The President announced the death of Albert S. Glover, a member of the Society, which occurred on April 23, 1917, and by vote he was authorized to appoint a committee to prepare a memoir. The President has named, as that committee, Messrs. Richard A. Hale and Charles W. Sherman.

On recommendation of the Board of Government, it was voted to hold the next regular meeting on June 13, 1917.

The Board of Government recommended the adoption of the following resolution:

Whereas, engineers and engineer troops are of prime importance in modern warfare, and

Whereas, the organization of engineer troops is particularly a subject for coöperation on the part of societies of engineers, and

Whereas, a regiment of engineers is now being organized in the Massachusetts National Guard, by the transformation and enlargement of the First Corps of Cadets; therefore

Be It Resolved, that the Boston Society of Civil Engineers endorses the formation of such regiment of engineers, and pledges to it its support and assistance.

On motion of Mr. Sherman, the resolution was adopted by a unanimous vote. The President stated that, in accordance with the requirement of the constitution, the resolution would be submitted to the full membership by letter ballot.

By vote, the Board of Government was authorized to canvass the letter ballot and report to the Society at the next meeting.

The President submitted, for the Board of Government, its recommendation that a sum not exceeding five hundred dollars be appropriated from the income of the Permanent Fund for the improvement and furnishing of the Society rooms. On motion of Mr. Marston, the following vote was adopted unanimously, 36 voting in its favor:

Voted: That a sum not exceeding five hundred dollars be appropriated from the income of the Permanent Fund for the improvement and furnishing of the Society rooms.

The President then introduced the first speaker of the evening, Lieut. George D. Murray, United States Navy, who addressed the Society on "The Problems of Aviation as Applied to the Navy."

Mr. Greely S. Curtis described in a most interesting manner, with the aid of lantern slides, various forms of air planes, particularly those made by the Burgess Company, of Marblehead.

Prof. Edwin B. Wilson, of the Massachusetts Institute of Technology, spoke briefly of the theory of the aeroplane, and

Mr. Clifford L. Webster, aviator for the Burgess Company, gave some interesting experiences in aërial navigation and method of instructing pupils.

A general discussion followed, in which the speakers of the evening freely answered many questions propounded to them.

On motion of Mr. Gow, the thanks of the Society were voted to Lieutenant Murray, Professor Wilson and Mr. Webster, for the interesting addresses and discussions which they had contributed.

Adjourned.

S. E. Tinkham, *Secretary.*

APPLICATIONS FOR MEMBERSHIP.

[June 4, 1917.]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

Gould, Gardner Sabin, Needham, Mass. (Age 31, b. Newton Upper Falls, Mass.) Graduate of Mass. Inst. of Technology, 1907, civil engineering course. From 1907 to 1910, with W. S. Johnson; from 1910 to 1911, with W. H. McElwain Co.; during 1912, with Boston Cons. Gas Co., construction department; from 1913 to 1915, with F. A. Barbour on water-works design and construction; during 1916, with Moulton Engrg. Corp'n, Portland, Me., on wharf and heavy mill construction; is now superintendent for Roy H. Beattie, Inc., on harbor and wharf construction. Elected a member of Sanitary Section October 7, 1908, and now desires to be transferred to full membership in the Society. Refers to F. S. Bailey, F. A. Barbour, H. N. Cheney, J. A. Gould, W. S. Johnson and D. S. Reynolds.

TERHUNE, EDWARD ANDRUS, Jr., Dorchester, Mass. (Age 22, b. Dorchester, Mass.) Senior at Tufts College Engrg. School, structural department. Refers to E. H. Rockwell, F. B. Sanborn, R. C. Smith and H. H. Terhune.

LIST OF MEMBERS.

ADDITIONS.

DELANO, RAY O....,............................North Duxbury, Mass.

DEATH.

LOCKE, FRANKLIN B....................................May 11, 1917.

LIBRARY NOTES.

BOOK REVIEWS.

STATE SANITATION, Volume I, by George Chandler Whipple; published by Harvard University Press, Cambridge, Mass. Cloth, 6 in. by 9 in., ix+377 pages, 20 illustrations. $2.50.

*Reviewed by Harrison P. Eddy.**

A review for the JOURNAL of the Boston Society of Civil Engineers, of a book written by the Society's President, devoted to the past work of the Massachusetts State Board of Health, so largely executed by members of the Society, appears to be very much of a family affair. To those who have been looking forward to the publication of Professor Whipple's latest book, it will be distinctly pleasing to have the first volume, which contains, in Part I, a review of the work of the Massachusetts State Board of Health and, in Part II, the classic report, somewhat abridged, of the Massachusetts Sanitary Commission of 1850. In presenting the subject of state sanitation the writer has very appropriately utilized the history of sanitation in Massachusetts as the basis of his discussion. To many readers, history is dry and tiresome, but the author has so presented it in this volume that it is inspiring as well as entertaining.

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* Of Metcalf & Eddy, 14 Beacon Street, Boston, Mass.

The description of the early history of public health in Massachusetts, as presented in the first chapter, is replete with interesting facts, such as the introduction in 1800 of the process of vaccination for smallpox, by Dr. Benjamin Waterhouse; the discovery, by Dr. W. T. G. Morton, in 1846, that sulphuric ether would produce anesthesia, and the formation of the Boston Aqueduct Company in 1795, to bring water into the city from Jamaica Pond, a distance of 4.85 miles, to a reservoir at Fort Hill. Later, the report of the Massachusetts Sanitary Commission of 1850 is brought to the attention of the reader, and a brief account is given of the work of Lemuel Shattuck, to whom the author gives much credit for originating the movement resulting in the appointment of the commission, and also for a major part in the preparation of the notable report which to-day rings true in almost every detail after fifty-six years of the most remarkable discovery and progress in sanitary science the world has ever seen.

The organized work of the state in the field of public health is divided into the following four epochs:

Beginnings of the State Board of Health, 1869–1879.
The Board of Health, Lunacy and Charity, 1879–1886.
The State Board of Health Reorganized, 1886–1914.
The State Department of Health, 1914–1916.

In discussing the methods of the board, the author states:

> "Its organization and work have been non-partisan; its functions have been conceived to be advisory rather than coercive, educational rather than punitive, yet, when occasion required, it has not hesitated to demand the exercise of the police power of the state through its legal machinery."

The third epoch will prove familiar reading to many recipients of the JOURNAL, for within it have been conceived and executed the Lawrence Experiment Station and its work, the Metropolitan Sewerage Works, the Lawrence water filter, the Metropolitan Water Works and the Charles River Basin — all works in which the members of the Boston Society of Civil

Engineers take just pride. They are the accomplishments of some of its most honored members. While these great enterprises, with the exception of the Experiment Station, were the work of other public boards, they were passed upon in one way or another by the state board of health.

In the fifth chapter the author discusses in an interesting manner the " Health of the People," and points out the " rather peculiar fact that the only way in which we measure the health of a people is by taking account of the amount of sickness, or the number of deaths which occur," and he states further that " the time is coming when we shall measure health not in terms of doctor's bills, but in stature and strength, and the ability to work and to enjoy life; while the healthfulness of a place will be measured not only in terms of death-rates but by the capability of the environment to promote good living."

The chapter upon " Protection of the Purity of Inland Waters," starting with the Act of 1886, giving the state board of health general oversight and care of all inland waters, deals with the several and various activities of the board under this authority; while the chapter upon the " Lawrence Experiment Station " gives to the board credit for the experimental work which has been accomplished at this station.

Passing rapidly over " Later Engineering Work " and the " Cost and Achievements of the State Board of Health," one comes to what is perhaps the most interesting chapter in the volume, — " Personalia," — where will be found a most fascinating discussion of the part taken in the work of the Board, by many of its illustrious members and employees. Due credit is given to Dr. Henry P. Walcott, chairman 1886–1914, during which time the board " spent over two million dollars of the state's money for purposes of public health through the appropriations for the state board of health, and made recommendations which resulted in the expenditure of sixty million dollars for the Metropolitan water supply, Metropolitan sewerage works and other public improvements." That such sums were forthcoming throughout a period of about twenty-nine years is a sufficient testimonial of the public confidence in the personnel of the board and its policies. Among the past and present members of the Boston Society of Civil Engineers thirty-six are mentioned as having been connected with the work of the board, including Hiram F. Mills and Frederic P. Stearns, both honorary members of the Society.

The report of the Massachusetts Sanitary Commission, comprising the second part of the volume, was dated April 25, 1850, and sets forth a "Plan for a Sanitary Survey of the State," with remarkable clearness and insight into the requirements for and scope of the work of a state board of health even in modern times. The author makes the following interesting comment upon this report:

> "In reading the report, one omission will be found conspicuous; there was no reference to bacteriological science; for this was long before the days of Pasteur. All the more remarkable, therefore, were the plans presented. Without a knowledge of the germ theory, Shattuck had an abiding faith in preventive medicine. Perhaps, after scientists have pushed bacteriological methods to their natural or economical limit, they will turn back to the simple and fundamental principles of sanitation so well set forth in this classic report."

REINFORCED CONCRETE DESIGN TABLES: A Handbook for Engineers and Architects, by M. Edgar Thomas and Charles E. Nichols. New York: McGraw-Hill Book Co. Flexible leather, 4 in. by 7 in., 208 pages. $3.00.

*Reviewed by George H. Stearns.**

This handbook is intended, as the authors state, to serve the same purpose for the designer in reinforced concrete that the handbooks of the various steel companies do for the designer in steel.

The book includes about 200 pages of tables and explanations, covering a wide range of specifications.

The notation is that of the Special Committee.

The tables include slabs, simple and T beams, beams with compression steel; also square, round and hooped columns and longitudinal and hooping steel.

The book is of handy size and shape; the tables are clear and well arranged, and have been found by trial to well serve the purpose for which they were intended.

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* Assistant Engineer, Boston Transit Commission, 15 Beacon Street, Boston.

RECENT ADDITIONS TO THE LIBRARY.

On Military Engineering and Related Subjects.

Engineer Field Manual. Corps of Engineers, U. S. Army.

Military Topography for Mobile Forces. Capt. C. O. Sherrill.

Sanitation in War. Maj. P. S. LeLean.

U. S. Government Reports.

Baked Shale and Slag Formed by Burning of Coal Beds. G. Sherburne Rogers.

Mortality Statistics for 1915.

Newington Moraine: Maine, New Hampshire, and Massachusetts. Frank J. Katz and Arthur Keith.

Public Road Mileage and Revenues in Central, Mountain, and Pacific States, 1914.

Triangulation and Primary Traverse, 1913–1915. R. B. Marshall.

Useful Minerals of United States. Frank C. Schrader, Ralph W. Stone and Samuel Sanford.

Water-Supply Papers 396, 407, 416 and 417.

State Reports.

Connecticut. Annual Report of Public Utilities Commission for 1915–16.

Maine. Annual Report of Public Utilities Commission for 1916.

Massachusetts. Annual Report of Gas and Electric Light Commissioners for 1916.

Massachusetts. Annual Report of State Department of Health for 1915.

Municipal Reports.

Cambridge, Mass. Annual Report of Water Board for 1915–16.

Fall River, Mass. Annual Report of City Engineer for 1916.

Holyoke, Mass. Annual Report of Water Commissioners for 1916.

Milwaukee, Wis. Annual Report of Sewerage Commission for 1916.

Newton, Mass. Annual Report of Water Commissioner for 1916.

North Adams, Mass. Annual Report of City Officers for 1916.

Woburn, Mass. Annual Report of Department of Public Works for 1916.

Woonsocket, R. I. Annual Report of Water Commissioners for 1916.

Miscellaneous.

Bausch & Lomb Optical Co.: Range Finders for Army and Navy.

Elements of Euclid, with coloured diagrams and symbols. Oliver Byrne. Gift of Thos. W. Clarke.

Hydrated Lime Bureau: Modern Methods in Concrete Construction.

Public Utility Rates. Harry Barker.

Valuation, Depreciation and the Rate-Base. Carl Ewald Grunsky.

LIBRARY COMMITTEE.

NEW ENGINEERING WORK.

(Under this head a brief description of new engineering work contemplated or under construction will be presented each month. Engineers and contractors are requested to send descriptions of their work to the Secretary, 715 Tremont Temple, Boston, before 1st of each month.)

Commonwealth of Massachusetts.—METROPOLITAN WATER AND SEWERAGE BOARD. — *Water Works.* — On May 11, 1917, bids were received for a horizontal fire tube boiler for the Arlington Pumping Station, to be used in connection with a new centrifugal pumping unit, and the contract was awarded to the lowest bidder, the New England Iron Works Company, for $2,296.

METROPOLITAN WATER AND SEWERAGE BOARD. — *Sewerage Works.* — Work in progress: Section 98 and Section 102, Wellesley Extension.

Work contemplated: Sections 99, 100 and 101, Wellesley Extension; extension, Deer Island outfall.

Metropolitan Park Commission. — The following work is in progress:

Charles River Reservation. — The work of completing the construction of reinforced concrete bridge over the Charles River at North Beacon Street, Boston and Watertown, is in progress.

The work of completing the construction of reinforced concrete bridge over the Charles River at Commonwealth Avenue, Newton and Weston, is in progress.

General. — Work of road repairs in the various divisions is in progress.

Boston Transit Commission. — *Dorchester Tunnel.* — The work on Section F, which includes the Broadway Station and the approach for surface cars leading from Foundry St. to the upper level of the station, is in progress; also the widening of Broadway and a portion of the Broadway bridge to make room for an enclosed surface transfer area.

Work on Section G is in progress at and near the bridge over the New York, New Haven & Hartford Railroad tracks near West Sixth St.

Work on Section J, at Andrew Sq., for the Andrew Station, is in progress.

Summer St., over a portion of the tunnel extending from High St. to the bridge over Fort Point Channel, is being repaved with new granite blocks with cement grout joints.

City of Boston. — Public Works Department, Highway Division, Paving Service. — Work is in progress on the following streets:

Gaffney St.,	Commonwealth Ave. to B. & A. R. R.	Asphalt.
Fordham Rd.,	Commonwealth Ave. to Brighton Ave.	Asphalt.
St. Rose St.,	South Street to 415 ft. northerly.	Bituminous macadam.
Granada Ave.,	Metropolitan Ave. to Ethel St.	Bituminous macadam.
Cornell St.,	Orange St. to Colberg Ave.	Bituminous macadam.
Caledonian Ave.,	Spring St. to 200 ft. northerly.	Grading.
Patten St.,	Hyde Park Ave. to Bourne St.	Bituminous macadam.
Lorne St.,	Harvard St. 650 ft. northerly.	Asphalt.

Epping St.,	Washington St. to Norfolk St.	Asphalt.
Lithgow St.,	Talbot Ave. to Wainwright St.	Asphalt.
Hill Top St.,	Granite Ave. to Hallet St.	Bituminous macadam.
Caspian Way,	Savin Hill Ave. to 520 ft. easterly.	Bituminous macadam.
Harwood St.,	Willowwood St. to Lucerne St.	Asphalt.
Upland Ave.,	Park St. to Melville Ave.	Asphalt.
Amory St.,	Centre St. to Bragdon St.	Granite block.
Homestead St.,	Humboldt Ave. to Elm Hill Ave.	Asphalt.
Albany St.,	Dover St. to Northampton St.	Granite block.
Canal St.,	Haymarket Sq. to Causeway St.	Granite block.
McKinley Sq.,	State St. to Central St.	Granite block.
Beach St.,	Harrison Ave. to Atlantic Ave.	Granite block.
Haymarket Sq.,		Granite block.
Tyler St.,	Oak St. to Curve St.	Asphalt.
West Broadway,	Dorchester Ave. to E St.	Asphalt.

New York, New Haven & Hartford Railroad. — CONSTRUCTION DEPARTMENT. — Progressing on erection of engine facilities at Southampton St., Boston, Mass. Work consists of new 39-stall engine house, 95-ft. turntable, ash pits, boiler house, office building, water tank and necessary trackage.

Aberthaw Construction Company. — Has following work of interest:

New shipways for the Fore River Shipbuilding Corp., at Quincy, for the 50 000-ton battle cruiser. This is a shipways complete, including foundations, grading, and superstructure of steel and four heavy cranes, three with a lifting power of 7½ tons, one with 50 tons. These cranes have a span of 130 ft. approximately. This is a rush job for the Government, and is to be finished in September.

A factory 150 ft. x 400 ft., for the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., for the manufacture of revolvers. This is an unusually fast job. From contract to completion, ready for the installation of equipment, there is but little over three months.

We are also building at Donora, Pa., one hundred monolithic concrete residences for workingmen for the American Steel and Wire Co. This is a new departure in the construction of workingmen's homes, and should be of interest to the engineering profession.

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PAPERS AND DISCUSSIONS

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THE ENGINEERING SOCIETY IN WAR TIME.

BY GEORGE C. WHIPPLE, PRESIDENT BOSTON SOCIETY OF CIVIL ENGINEERS.

(Presented April 11, 1917.)

AT this first meeting of the Boston Society of Civil Engineers since the declaration of war, the first meeting also at which I have had the honor to preside, I take the liberty of saying a few words as to what our Society should do in war time in order that it may best fulfill its mission, — for I take it that societies as well as individuals must stand ready to do their bit and make such sacrifices as may be necessary for the good of their country. War to-day is, more than ever before, dependent upon the knowledge, skill, imagination and foresight of the engineer. It is dependent also upon organization. It would therefore seem that a society of engineers, composed of educated men skilled in the many branches of engineering science and drawn together by bonds of personal friendship and love of their profession, should be able to do something for the public good which its members cannot do as individuals. What these things are cannot be detailed now. They will develop as the war progresses. That there is work ahead for the Society seems certain. Permit me to make a few general suggestions.

The first is that the meetings of the Society should be kept up. More than ever it will be desirable that we get together and discuss the engineering problems of the war and stimulate our interest in all branches of science. Our regular meetings should be largely attended, and there should be many special meetings for conference and discussion. Our wits must be sharpened in all possible ways, lest we find ourselves at our wits' end.

My second suggestion is, that, while we meet often, our entertainments and refreshments should be modest and inexpensive, befitting the serious days which lie ahead. It may be necessary to give up some of our customary excursions.

Thirdly, we must rapidly educate ourselves in the elements of military engineering, — because the differences between engineering in times of peace and engineering for war purposes are much greater than most of us realize. We must learn how to adapt ourselves to new conditions, to appreciate the spirit of the military engineer in order that we may aid him if we do not wear the uniform, and in order that we may wear the uniform ourselves if duty calls us. Sanitary engineers are just now surprised and disappointed to learn that because they have no medical degree the army regulations do not permit them to enter the Medical Department, in which the authority over sanitary matters is vested, and that in the engineer corps to which they are eligible there is little or no opportunity to utilize their knowledge and experience. If this anomalous, perhaps calamitous, situation cannot be changed, it will be necessary for sanitary engineers to perform their work as civilians, or to serve the country in other ways. I cannot believe, however, that the situation will remain as at present when once the country realizes that all possible resources are not being utilized by the army to protect the health of soldiers and citizens.

Perhaps the first constructive work which our society can do is to stand solidly behind the new regiment of engineers now being organized in New England. This meeting was called in part to encourage the formation of an engineer corps. Since the call, the First Corps of Cadets has voted to recruit itself to six companies and become a regiment of engineers. We congratulate the organization on its action, and we congratulate the state that it is at last to add an engineering unit to its otherwise well-rounded force, and that the regiment bids fair to be composed of officers and men of exceptional ability. Some of our members are already officers in this regiment, and doubtless there will be others. This Society, which contains representatives of so many different interests, men who are in close touch with artisans and skilled laborers of all kinds, ought to be of material assistance in recruiting this engineer regiment. It would not be out of place to appoint a special committee to attend to this matter, and to the more general question of engineering service in the United States Army and Navy. Our Society rooms, so well located in the heart of the city, might well be made a center for all matters connected with military engineering.

Also, our Society should keep track of its members who undertake active service, and see to it that no engineer's family suffers from want, and that, so far as possible, the men who go into service do not suffer loss of position by reason of their sacrifice.

Finally, it should be remembered that it is the duty of the engineer to keep things going. He serves his country well who does that duty which is most needed and for which he is best fitted, — whether in uniform or not. Most engineers can probably be of greatest service by helping to keep the wheels of industry and transportation moving, by seeing that the power is kept up; that supplies are ready when needed; that the railroads and highways are always passable; that the bridges are strong enough to bear unusual loads; that water supplies remain ample and safe; that the different kinds of engineering work are properly interlocked. The mutual acquaintanceship of engineers in this Society should do much to make all these activities fit together and run smoothly.

It has been suggested that it would be a good idea for some of our members to contribute to a flag, to be displayed at all our meetings during the war. I heartily approve of the idea, but the Boston Society of Civil Engineers needs no stimulus to its patriotism; she welcomes this opportunity to serve her country, and pledges to the President of the United States the loyalty and support of nearly a thousand engineers.

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MILITARY SANITATION.

By W. P. Chamberlain, Lieutenant-Colonel Medical Corps, U.S.A.

(Presented April 11, 1917.)

The importance of protecting the health of armies is so well recognized to-day that it is only necessary to state that numberless expeditions and campaigns in the past have failed in whole or in part as a result of disease among the troops. One might write an interesting review of history as modified by epidemic disease in armies. I shall to-night only touch briefly on some of the points in military sanitation where the engineer and the physician meet on common ground and where each can be of assistance to the other.

The so-called water-borne diseases have always played an important part in the morbidity and mortality of armies. Typhoid fever, paratyphoid fever, Asiatic cholera, and dysentery are the principal members of this class of maladies. It has come to be recognized of late years that these diseases are conveyed by agencies other than water, — notably flies, dust and contact. Nevertheless the importance of providing safe drinking water is very great, and it is almost equally necessary that sufficient water for proper cleanliness should be provided. In permanent camps, in trenches which are to be occupied for some time, and in fixed military stations, the providing of an adequate water supply is essentially a matter of engineering, and the purification of the supply, if not above suspicion, also demands the services of the sanitary engineer.

In the field and on the march the problem of purifying doubtful supplies requires much attention. In many foreign armies, water carts have been devised, some of which make provision for sterilization by chemicals or by some physical means, such as heat or the ultra-violet rays. We attempted to sterilize water in the field by heat, in the Forbes-Waterhouse sterilizer, but this did not meet all the conditions satisfactorily. The Darnall Filter, which filtered water through outing flannel after using a coagulant, has fallen into disuse because of its bulk. We now depend in the field upon the water sterilizing bag, commonly known as a Lyster bag, taking its name from its originator, Major Lyster, of the Medical Corps. This bag is made of canvas and is 20 ins. in diameter and 28 ins. long. It holds sufficient water to supply a company of infantry at war strength with one canteen full per man. The bag has five spring faucets at the bottom. It weighs about 8 lbs. Calcium hypochlorite is carried in amber glass tubes, in such amount that, when added to the bag full of water, a strength of one part of chlorine in 500 000 is produced. A box weighing 10 oz. contains sufficient hypochlorite tubes to sterilize 5 canteens of water per day for twelve days for one company of infantry. Tubes retain efficiency for ten months.

As a result of oxidation, bacteria are killed promptly, cholera and typhoid bacilli being destroyed in five minutes. Amœba and ciliates, two common protozoal causes of diseases, are killed in fifteen minutes both in the vegetative and the encysted stage. This apparatus is now furnished by the Quartermaster Corps, and one is issued to each company for use in the field.

The number and variety of the means employed to sterilize water in the field are sufficient evidences that the perfect means has not yet been discovered. There is still room for the sanitary engineer to work along this line. Another somewhat allied problem is the devising of a thoroughly satisfactory wheeled kitchen for troops.

Equally important with the supplying of pure water is the proper disposal of the excreta. With a marching command the use of pits, filled in each day on leaving, is satisfactory. In permanent or semi-permanent camps, something better must be devised, and of course a water-carriage system best meets the needs but is often impracticable. Incineration of the excreta in camps has been tried but has proved unsatisfactory on account of the bulky equipment needed, the expense of operation and the frequent bad odors resulting from the process. The main object to be attained in camp is to keep the flies away from the excreta. This is now managed by the use of a box placed over pits about five feet deep. The box is made as near fly-proof as possible, the seat holes are provided with covers closing automatically, and earth is banked up about the base where the box rests upon the ground. Daily the box is lifted off from the pit, and a fire of oil and straw is made in the pit with a view to destroying paper, sterilizing the walls of the pit and killing any fly eggs which may have been deposited. Recently we have used on the Mexican border the plan of spraying the interior of the pits and boxes with a mixture of coal oil and lampblack or boneblack. This has worked well, the dark interior of the trench and the odor of oil rendering the locality distasteful to the house fly.

There is still room for the sanitary engineer to improve upon the methods of disposing of excreta in the field.

In semi-permanent camps we now dispose of garbage by incineration adjacent to each company kitchen. If the garbage is carried to a central incinerator, some is scattered about the camp, attracting flies; and the garbage receptacles also draw flies. Liquid garbage is evaporated on the rocks, if the incinerator is built of rocks, or in shallow galvanized iron pan if it is built of brick.

There is an excellent opportunity for an engineer to devise a kitchen incinerator which will be simple, cheap, efficient and less wasteful of fuel than our present ones. There is also a similar opportunity for improvement in the handling of horse manure, which, as you doubtless know, is the chief breeding place for the house fly, one of the greatest menaces to health in camp. At present, when the manure from camps cannot be safely disposed of to farmers, it is generally hauled to a distance and burned on the surface of the ground with the aid of crude oil.

Through the efforts of English army surgeons, it was shown that malaria is transmitted from man to man by the Anopheles mosquitoes. You are doubtless all aware that, through the brilliant experiments of members of our own Medical Department, Majors Reed and Carroll, and Contract Surgeons Lazear and Agrimonte, it was shown that yellow fever was carried by the bite of the Stegomyia mosquito. As a result, Cuba has been freed from yellow fever, and the control of yellow fever and malaria rendered possible the building of the Panama Canal. The control of the mosquito pest is a matter in which great assistance can be rendered by the engineer. Doubtless you are all familiar with the subject as handled at Panama. Among the points to be considered are, the draining of pools and swamps; the application of oil or other larvicides to standing water which cannot be drained away; the construction of concrete drains which leave no pools when flow ceases; the removal of grass and brush from the edges of such drains by burning or otherwise; the removal of aquatic vegetation which protects mosquito larvæ from oil and from predatory fish; the providing of non-sagging gutters for houses; the screening of houses against ingress of mosquitoes, and the proper screening or covering of water receptacles so that mosquitoes may not breed in them.

In time of war, the construction of the hospitals made necessary by the military operations is transferred from the Quartermaster's Corps to the Engineer Corps. Here is a field offering great opportunity for the engineer to devote himself to promoting medico-military preparedness. Problems of ventilation, heating and lighting, and also of protection against insects and against injurious glare, must be worked out. Rapid, cheap construction will usually be demanded, and attention should be given to standardized portable buildings with the material cut the proper size at the mills. Our military attachés in France have recently reported on types of barracks built along these lines by the French and the English, and the Red Cross Society in this country is working upon the same subject at present. The United States Army plans for base hospitals are now under revision by a board which will investigate all the hospitals constructed last year along the Mexican border.

The foregoing remarks indicate some of the matters in which the engineer may be of direct and vital assistance to the military sanitarian. Work which the engineer may do in promoting sanitary progress will have an important bearing on the ultimate military success of the nation. In the past, enormous losses and untold suffering have resulted from the outbreak of preventable disease among the soldiers. Only in the last few years has it become possible to keep large aggregations of men in good health while in camp. As an example of progress, let me cite the following comparison: In 1898 our forces mobilized for the Spanish War had 22 000 cases of typhoid fever, with 2 100 deaths. Most of these cases were infected in the United States. In 1916 we mobilized about the same number of troops along the Mexican border. We have had 46 cases of typhoid, with 2 deaths. Surely a most gratifying comparison! Other sanitary problems still remain to be worked out, and for their solution let the physician and the engineer march hand in hand, assured that by coöperation lasting success will be achieved.

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PAPERS AND DISCUSSIONS

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ORGANIZATION AND DUTIES OF ENGINEER TROOPS.

BY FREDERICK B. DOWNING, CAPTAIN CORPS OF ENGINEERS, U.S.A.

(Presented April 11, 1917.)

I SHALL undertake to describe, briefly, enough of our army organization to make clear the usual assignment of engineer troops therein and tell you something of their duties.

The battlefield of to-day is a very extensive area. In the days of the Civil War, perhaps five square miles was the average size of a battlefield, but to-day it is three or four miles in width and three or four hundreds of miles in length. It is marked by a very elaborate system of trenches that run hither and yon in every direction.

The field is apportioned to certain major units of the army that are called divisions. Each of these divisions will comprise about twenty thousand fighting troops and will occupy a section of the battlefield perhaps three or five miles long. Just behind the battlefield proper are the division headquarters, — one for each division. They are placed sufficiently in rear of the fighting troops to provide reasonable safety to the large quantities of supplies that are concentrated at depots in the vicinity.

Between the division headquarters and the fronts of the divisions operate long trains of motor trucks and wagons which are generally organized into four distinct systems, for the supply of ammunition, quartermasters' stores and sanitary materials.

The fourth system comprises the trains carrying the engineering supplies.

The battle ground, and all of the territory referred to above, is included in what is called the " zone of the advance," and it is this zone which is occupied by the fighting troops. I use the terms " zone of the advance " and "zone of the line of communication " with the purpose of bringing out the distinction that the chief of engineers has made to exist between the " B " service and " A " service of the Engineer Officers' Reserve Corps. The B service is the one in which it is expected that an officer will have but little need of military experience, and is on the line of communications. The A service is the more strictly military duty, is in the zone of the advance, and is called "service of the front."

Back of the zone of the advance is the zone of the line of communications. It takes its name from the fact that it is traversed by a route—usually a railroad — which is the line of communications, and over which the supplies are carried to the front.

Let us start at the rear end of this line of communications which is at the base of the army, and travel forward, making a brief survey as we go. As we leave the base we pass near a very large camp. The men are in barracks or wooden shelters or large tents, in permanent camps, — a large body of troops; estimated at about one hundred thousand. That is the strategic reserve of the army. The whole army comprises at least five hundred thousand men, most of whom are in advance of the base.

Going forward along the line of communications are great numbers of railroad trains. Moving forward, they are full of ammunition, clothing, materials for the repair of trenches, railroad material, and other supplies. Coming back, most of the trains are empty, else they are loaded with worn-out stuff, — materials and men.

As we go along this railroad we see that at practically every important junction, at all of the bridges, and in the larger towns, troops are stationed; and in every instance they are protected by permanent fortifications that have been erected by the engineers in the service of the line of communication. We also see that the original railroad has been supplemented by additional tracks and that a number of new branch lines, spurs, sidings and yards have been constructed to facilitate the transport and storage of material.

Perhaps eighty miles in front of the base of supplies we arrive at the headquarters of one of the field armies. This field army, we are informed, consists of three divisions; and it constitutes one main section of the long front of the battle line. Within a few miles of army headquarters there is a mobile reserve which is to be used when needed for the reinforcement of any weak or threatened part of this section of the front. In front of army headquarters, and spreading out somewhat like a fan, are the headquarters of each of the three divisions, which we remember are placed near the rear edge of the zone of the advance. We proceed to division headquarters and find that the old roads have all been rebuilt and many new ones constructed. These reach forward over devious ways and end in the covered communications or protected roads among the trenches of the battlefield. We have now traveled up to the fighting position of one field army. We recall that on its right and left are other armies that are organized similarly, and each of which numbers its men in hundreds of thousands.

Now let us see what the engineers are doing. The zone of the line of communication is under the command of an officer termed " the commander of the line of communications," and on the staff of this officer there is one who is called the " director of railways." He is an engineer officer and operates and maintains the railroad from the base to or near the division headquarters. He has charge of the construction, operation and maintenance of all the railroads of the line of communications, and of the establishment of additional trackage and storage facilities for yards, depots and parks required for the advance bases. The personnel which the director of railways controls consists largely of civilians. But, in addition, there are organizations of engineer troops that are regularly assigned to the line of communications, and some of these are railroad troops. Such troops have an organization similar to the divisional engineers that serve with the combatant troops.

In addition to the railroad engineers there are other troops on the line of communications which usually are pioneer engineers as distinguished from pontonier engineers, — the latter being those that build the bridges. The pioneer troops fortify the base, supervise the construction of the camps, establish and operate the water-supply systems, build and maintain the sewerage systems, and, if necessary, erect lighting plants and operate them; and maintain factories for the supply of fortification materials. They are also engaged when necessary in the construction of wharves, warehouses and hospitals, and in the erection and operation of power plants for various purposes.

On the staff of the commander of each army, — and it is to be understood that the armies are individually commanded by generals, and the grand army by a general-in-chief,—on the staff of the commander of each army there is a chief engineer. Under the direction of the chief engineer of the army, the roads and railroads in advance of army headquarters have been built or reconstructed. Under him are the divisional engineer troops, and other engineer officers in the service of the front that are engaged in conducting what might be called the public works of the army. The chief engineer of the army has charge of all military surveys and reconnaissances; and of the preparation, reproduction and issuing of all maps for the use of the army. He builds and operates power plants and factories, especially for the supply of lumber that is necessary in rebuilding trenches and dugouts.

To each division of the army there is attached one regiment of engineers. These divisional engineer troops are used principally in determining the positions and supervising the construction of trenches, trench communications, shelters and bombproofs; in making surveys and maps; in building roads and bridges; and in placing military obstacles. The latter may consist either in the construction of a dam to flood the country, or the digging of what is called a military pit, the building of a barbed wire obstacle, or the felling of a forest. They are also engaged in digging shafts and galleries; in lining them; in locating and destroying the enemy's works by exploding mines; and generally, in retreat, in destroying the military resources of the enemy.

Now I have very briefly outlined the duties of engineer troops, but if I have left you with the impression that the work of fortification referred to is entirely done by the engineers, I have given you a wrong impression. You will get some idea of the enormous amount of work that is entailed in the mere collection of the material that is necessary to be built into the defenses of various sorts when you realize that to fortify some parts of a line of battle as it exists in France to-day, a single mile of completely entrenched line may require one thousand miles of barbed wire, one million running feet of lumber and six million sandbags. If the engineers had to do that work alone, it is conservatively estimated that it would take six years to finish the entrenchments. The truth is that the fighting troops — principally the infantry — must do the great part of the entrenching, and thus they leave the engineers free to supervise the especially nasty jobs and to execute the most difficult work.

I should like to impress upon you the fact that the entire region back of the battle front proper is under military control. It is administered for engineering construction and for the operation of public utilities by troops in the military service. It is hardly too much to say that any practical engineer, any one who has experience in construction, or any skilled mechanic, can find his place, and a very useful place, in the military organization of engineer troops. I should like in this connection to emphasize some of the remarks of your president. Fighting with the armed troops in the military service is not the only place where engineers will be useful. They may serve in the factories at home, on the lines of communication in rear, or with the fighting troops at the front. But when we begin to train an army of millions we have got to have fighting men. You cannot have an army without them. I have come rather closely in touch recently — and I am happy that I have done so — with a number of men, old and young, who do not yet know what they ought to do. They are anxious to do the right thing. I do not think it is my part to advise individually what a man should do, but I do feel that if you are young and strong and want to find your place, you will be most welcome at the front, fighting.

Now, as to what New England should do to furnish engineer troops. Let us make a hasty estimate. Let us figure, first, what a division is. An infantry division consists of three brigades of infantry, a brigade of artillery, a regiment of cavalry, a regiment of engineers, a field battalion of signal troops, an aëro squadron, an ammunition train, a supply train, a sanitary train and an engineer train, — in all, something like 20 000 fighting troops. Now let us assume that an army of sixty divisions is to be furnished by the United States, — that is approximately one million two hundred thousand men. Each division will consist of what I have just outlined. To each division that is at the front there is assigned a regiment of engineers, and to each group of three divisions another regiment of engineers. That is, the ratio of assignment is four thirds of a regiment of engineers to each division. The above are with the fighting troops, in the zone of the advance, —in the A service. In addition, there should be, on the line of communications for each group of three divisions, at least one regiment of engineers as railroad engineers and another regiment as pioneer engineers, which adds, therefore, another quota of two-thirds of an engineer regiment to each division of troops. The quota of engineer troops, therefore, is two regiments of engineers for each infantry division. Now, if the army contains sixty divisions, I reckon that Massachusetts and the neighboring states should furnish at least two of these divisions. Therefore, the engineers from Boston and adjacent country would be four regiments. That is, if New England does its job, — and there is not a shadow of doubt in my mind but it will, — she will furnish for the engineers alone approximately one hundred and fifty officers and four thousand skilled men in the ranks as non-commissioned officers and privates.

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ENGINEERING INSTRUCTION NOW BEING GIVEN BY THE FIRST CORPS CADETS, AND THE FORMATION OF A NEW ENGINEER REGIMENT.

BY JOHN F. OSBORN, CAPTAIN FIRST CORPS OF CADETS, MASSACHUSETTS NATIONAL GUARD.

(Presented April 11, 1917.)

WHEN I accepted the invitation of your committee, about two weeks ago, to talk before you, I hardly realized the march of events which would take place from that time until to-night. To illustrate the uncertainties constantly arising during this time, I might cite to you an occurrence at a meeting of a board of officers at the South Armory, a short time ago. Some question arose as to the latest interpretation of a certain portion of an order which had been published. A prominent regular army officer at that time was trying to explain the intent of the order. He said, as he looked at his watch, "Gentlemen, all I know is that up to 8.15 this order was in force. I do not know what may have happened in the last twenty minutes."

Matters are in the same condition now. Things are moving, and we do not know just what will happen to the National Guard, what will happen in regard to compulsory military service, and in regard to a few other things which are at present engaging our attention. I am not much of a speechmaker, and I shall give you no technical talk. I am merely going to tell you in a conversational way what we have been doing and what we are trying to do in order to start a new engineer regiment. In the past ten days or so, I have endeavored to explain to various meetings what we are doing. I have answered questions or have tried to answer them, to the best of my ability, and I will try to do so to-night if any one has any doubtful points to clear up.

This matter of an engineer regiment here in Massachusetts has been simmering for some little time. I should say it was about three years ago that Major E. T. Cole, U.S.A., retired, and now stationed at Technology, interviewed the Adjutant-General with regard to forming an engineer battalion in this state. At that time things were different than they are now. We did not know that engineer troops would be needed for some time to come. At any rate, the major did his best to get this battalion started; but at that time it was turned down. He has since given considerable time and a great deal of assistance in trying to push this matter to some conclusion. Personally, on two or three occasions I have tried to get something started; I found out what the major had done, and together we tried to get something under way.

Last June, subsequent to the passage of the National Defence Act on June 3, Circular No. 2 of the Militia Bureau of the War Department was published, calling for a regiment of engineers for the state of Massachusetts, to complete the Fifth Division of the National Guard. This division includes, as you have heard before, the National Guard troops of New England. I received a copy of this circular in the middle of the summer, while I was on recruiting duty, and I determined when I came back to Boston to see what could be done toward pushing this matter further. With the permission of the commanding officer of the First Corps of Cadets, and with the help given me by Major Cole, and through the personal attention given by Captain Downing, to whom you have listened to-night, we were able in a small way to start some instruction in my company of the First Corps of Cadets. I made this instruction compulsory in my own company, and endeavored to get men in the other companies interested, and with good success. I also made it possible for a certain number of business men or engineers outside, who were interested in the work, to come in and work beside our men, in order to get acquainted and to see if it was possible to get together a nucleus from which an engineer regiment could be raised. Our efforts were fairly successful, and before very long we had a number of men from the other companies watching our operations and finally asking for permission to join the class. We added men from outside, — some of you gentlemen here to-night, — who came and started in on this course.

Now comes the present condition of affairs, and the Militia Bureau has come forward and has asked that this regiment be formed. The Bureau has heard about the work we have been doing in the First Corps of Cadets and has asked our organization to consider the proposition of becoming an engineer regiment. We discussed the matter with our veteran members, with our active members and in the board of officers, and it was fully decided, after Major Mitchell of the Corps of Engineers in Washington came here to explain to us what the Bureau wished, that we would take the steps necessary to become an engineer regiment; and our acceptance of the proposition was wired to the War Department and the Militia Bureau. We then took the pains to push things as fast as possible. We found that it would not be necessary to introduce any new bill to the legislature, but that we merely had to go to the point of having the present militia law modified and changed somewhat. This has been done, or is being done at the present time.

You probably all know what is going on in Washington if you have been reading the papers. You probably have heard a number of reports regarding the First Corps of Cadets being turned down, and as to what we are doing. One paper went so far as to say that we were " mad clear through " on account of the order that we could not be recognized as engineers. I do not think that this was so. I think we were rather at a loss to understand the attitude of the War Department, until we began to read between the lines. As you all know, the matter of compulsory military service is receiving the greatest amount of attention in Washington at the present time. In order to get the compulsory service bill through, it is necessary to prove that other systems are failures. There may be some doubt in the minds of some persons as to the failure of the voluntary system. Personally, and as to the majority of the members of our organization, we would be very glad to see this bill for compulsory training go through. We feel that it is necessary. We do not like to have it said, however, that our efforts as volunteers or National Guardsmen have been an entire failure.

We would be pleased to have you call at our armory any night, and see what we are doing with regard to the recruiting of this engineer regiment. Personally, I can say that my company, B, up to last night had 183 men pledged for a necessary war strength company of 164, and they are still coming. I would say of these 183 men, however, that we have taken in some and merely enrolled them. We have examined them physically and made out all their papers; we are drilling them and doing everything we can to put them in shape, so that in case we are given the order to go ahead and enlarge to a full regiment we may have the requisite number to go to war strength almost immediately. In my active company, I am allowed, at present, a peace strength of but 100 men. I have at the present time in my active company, or did have up to last night, 68 men. I am, as you see, holding from actual enlistment a large number of men who are not engineers, and who are more or less ordinary men. What we want are men with brains; men who can execute an order when a fair explanation is given; men with strong backs and strong arms. We are getting these men. Last night I took in 9, and as soon as I get through here I am going over to the armory and see how many additional men I have to-night.

I am going to map out this work carefully, and I am going to have 100 men who will back me up and who are able to work with their brains as well as with their hands. We are going to get this regiment of six companies of 164 men per company. We are now a battalion of infantry of four companies, and we have about fifteen officers. We are required to have 36 for the regiment, and our officers are infantry officers in all cases except two. Some of them may resign or ask for a transfer, or they may be assigned elsewhere. Some of them will take up military engineering. You can see from this that we may have positions for 24 officers in the regiment; and there are more non-commissioned officers in engineer troops per company than in infantry.

We must obtain men for these positions who, if not yourselves, may be men in your employ who are of the right sort. We are taking in now such men as electricians, carpenters, blacksmiths and plumbers. The doors of our organization have been opened to men of brains, — good, clean men, strong and willing to work.

The matter of obtaining officers for the regiment will be handled in three ways. One of these consists in retaining the present officers in the corps who wish to stay and work to become engineer officers. The second way contemplates taking those officers who have been recommended to us by the War Department, as having satisfactorily passed the examinations for the position of engineer officers in the Reserve Corps of Engineers. The third way in which a man may become an officer in this engineer regiment is to join our organization as an enlisted man, show what he is worth, make himself valuable, be elected a commissioned officer, pass his examinations and be assigned to duty.

In talking over the matter of this regiment with other men, or when thinking it over yourself, estimate the value of this thing to the young men in your service, even though we may possibly have no war worthy of the name. We cannot, however, sidestep the fact that we are now engaged in and must take a part in the biggest war that the world has ever experienced. We do not know how much farther it will go; and therefore every young man should prepare for military service at once. Such service serves to instill, in the minds of young men, love of country, and the incentive to join in its activities grows. The outdoor life and the benefits that the man gets in improved conditions of health, etc., are inestimable. The discipline and training and the understanding of the value of organization to these young men will be worth a great deal to them when they come back to their peaceful pursuits. The friendships that arise in organizations such as I am asking you to have them join, or to go into yourself, are friendships which will never be forgotten. I have been in this thing for twenty years, but it does not seem to be a long time. After I started in I went with the Fighth Massachusetts Volunteers to Matanzas, Cuba. I had not been there very long before I ran across a man in another regiment, from Kentucky, whom I had known very well in college, and we agreed that the world was very small indeed. From that time until now I have passed through all grades with the First Corps of Cadets up to the position I hold at the present time. I served for a short time with the Eighteenth Infantry in Texas and made many friends there, and I hope to be with the First Regiment of Engineers of Massachusetts. In all this time I have made many good friends all over the country; and practically wherever I go I meet somebody who has known me or the organization in which I am now serving. This organization has had a hand in every war that the country has ever had. It has never gone out practically as a unit, but it has furnished a large number of officers. We are now arranging to send this organization as a unit; we want it to go out and make a name for itself, and we are taking in the right kind of men to do this. We want the personal help of every engineer in this Society.

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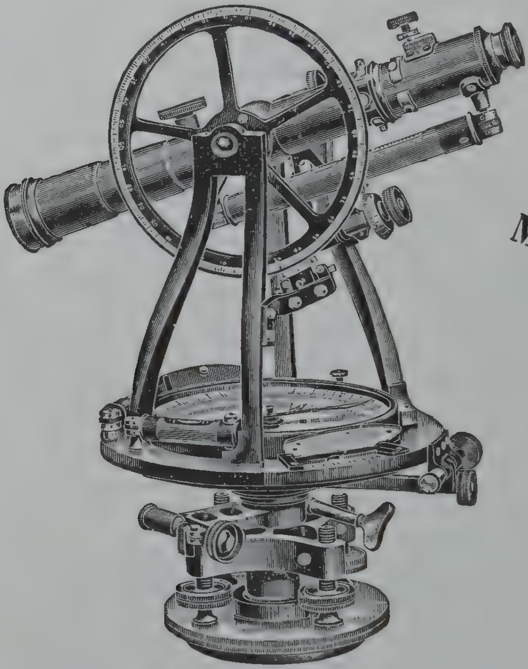

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